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| APPLICATION NO.  | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.            | CONFIRMATION NO. |
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| 10/017,494   | 12/07/2001  | Bulent M. Basol      | 042496/0277563<br>NT-0229(U)   | 5643             |
| 7590 08/25/2004<br>PILLSBURY WINTHROP LLP<br>1600 Tysons Boulevard<br>McLean, VA 22102 |             |                      | EXAMINER<br>CULBERT, ROBERTS P |                  |
|  |             |                      | ART UNIT<br>1763               | PAPER NUMBER     |

DATE MAILED: 08/25/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/017,494

Applicant(s)

BASOL ET AL.

Examiner

Roberts Culbert

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 03 August 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-65 is/are pending in the application.
- 4a) Of the above claim(s) 1-33 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 34-65 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 8/3/04 has been entered.

### ***Response to Arguments***

Applicant's arguments filed 8/3/04 have been fully considered but they are not persuasive. Applicant has argued that there is no objective reason to combine the references. The argument is not persuasive because there is a clear objective reason to combine Lee with the admitted prior art.

The admitted prior art teaches a deposition and removal process that uses a polishing pad apparatus to polish and planarize the surface of a wafer with a deposited metallic layer. (See Specification Page 5, lines 5-11) and U.S. Patent 6,176,992 (Col.2 Lines 18-30) cited in the background section of the specification. Note that the process of the admitted prior art uses chemical mechanical polishing during the deposition process, and further requires (CMP) for removal of the thickness of the deposited copper layer. (See Specification Page 5, Lines 14-20) Note also that the admitted prior art process measures the thickness of the copper layer that has been planarized or polished to determine the end-point of the process. Lee teaches a method of optical end-point detection suitable for a copper (CMP) process. The fact that Lee explicitly teaches that the end-point detection method is suitable for a copper (CMP) process, is an objective reason to combine Lee with the admitted prior art. Note that (CMP) means both "chemical mechanical polishing" and "chemical mechanical planarization", and the terms are synonymous in the art.

Applicant has argued "*Lee et al. discloses a method of endpoint detection for copper CMP (chemical mechanical polishing). The CMP process removes an already deposited metal layer. The CMP*

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*removal process is not concerned with material deposition or planarization but with endpoint detection to determine the lack thereof a layer of copper. In contrast, the present invention recites a method of detecting the degree of planarization of a material being deposited."*

The argument is not persuasive because although the examiner agrees that Lee discloses a method of endpoint detection for copper CMP and that the CMP removal process is concerned with endpoint detection to determine the lack thereof a layer of copper, the CMP process of Lee is also clearly concerned with both material deposition and planarization since the method of Lee teaches planarization of a layer that has been deposited. Furthermore, the claims of the present invention do not recite, "detecting the degree of planarization of a material being deposited". Moreover, a contrast of the method of Lee with the present invention is not directly relevant since Lee is combined with the admitted prior art and not the present invention in the rejections of the pending claims.

#### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors.

In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

**Claims 34-65 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art in view of U.S Patent 6,179,691 to Lee et al.**

The admitted prior art teaches an electrochemical mechanical deposition process that uses a solution containing a conductor therein and operates upon a work-piece top surface comprising the steps of: depositing the conductor to fill features within the top surface of the work-piece using electrochemical mechanical deposition employing a work-piece surface influencing device, an applied potential and the solution;

Regarding claim 51, the admitted prior art also teaches that the surface may be a conductive or insulator surface and that the step of operating deposits a conductor into the features disposed in the top surface of the work-piece.

The admitted prior art does not teach a method for detecting planarization of a top surface of a multi-layer work-piece by transmitting a beam of light onto the top surface of the work-piece to obtain a reflected beam of light, a characteristic of the reflected beam of light being altered by a top surface pattern that exists due to the features within the top surface of the work-piece; and detecting a change in the characteristic of the reflected beam of light indicative of a degree of planarization of the top surface of the work-piece.

Referring to figure 1 and the disclosure (Col. 3, Line 54-67), Lee et al. teaches a prior art method for detecting planarization of a top surface of a multi-layer work-piece by transmitting a beam of light (24) onto the top surface of the work-piece to obtain a reflected beam of light (26), a characteristic of the reflected beam of light being altered by a top surface pattern that exists due to the features within the top surface of the work-piece (Col. 4, Lines 10-13); and detecting a change in the characteristic of the reflected beam of light indicative of a change in the degree of planarization of the work-piece (Col. 3, Line 67, and Col. 4, Lines 7-10).

Regarding claim 52 the signal obtained in the detection method of Lee contains information indicative of a degree of planarity of the top conductive layer, since Lee measures the intensity of reflected light.

Regarding claim 53, Lee teaches detecting a characteristic of the reflected beam of light (intensity) and detecting (measuring) the characteristic of the reflected beam of light indicative of a change in degree of planarization of the work-piece and transforming the characteristic (intensity) into a signal (termination of the planarizing process), which corresponds to the degree of planarity of the top surface.

It would have been obvious to one of ordinary skill in the art at the time of invention to use the detection method of Lee to detect planarization of the surface being planarized in the method of the instant application since Lee teaches that the disclosed optical detection method is suitable for determining planarization of a conductive (copper) layer deposited on a substrate employing a work-piece surface influencing device.

Regarding claim 35, 46, and 54, Lee teaches that it is conventional to terminate the planarizing process when the intensity of the light beam reaches a certain level (Col. 4, Lines 4-7). Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention that the step of detecting a change further include the step of providing an indicator to halt the step of depositing when the top surface pattern of the work-piece reaches a predetermined degree of planarization, thus indicating the filling of the features with the conductor. One of ordinary skill in the art would have been motivated at the time of invention to halt the planarizing process as soon as the predetermined degree of planarization is achieved in order to reduce processing time.

Regarding claims 40, 42, 44 and 58 Lee teaches that the intensity of the reflected light is monitored (Col. 3, Lines 65-67)

Regarding claims 41 and 43 Lee teaches that the beam of light transmitted onto the top surface of the work-piece passes through the work-piece surface-influencing device.

Regarding claims 36-38, 47-50, 55-57, and 65, the admitted prior art teaches that it is conventional to form very thin planar deposits by first depositing a planar layer using an ECMD technique and then using an ECME technique on the planar film in the same electrolyte (within a same processing area) by reversing the applied voltage.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to provide a material removal step of chemical mechanical processing such as ECME.

Furthermore, since Lee et al. teaches a method for detecting planarization of a top surface of a multi-layer work-piece by transmitting a beam of light onto the top surface of the work-piece to obtain a reflected beam of light, a characteristic of the reflected beam of light being altered by a top surface pattern that exists due to the features within the top surface of the work-piece; and detecting a change in the characteristic of the reflected beam of light indicative of a degree of planarization of the work-piece, it would have been obvious to one of ordinary skill in the art at the time of invention to use the detection method of Lee to detect planarization of the surface being planarized in the method of the instant application since Lee teaches that the disclosed optical detection method is suitable for determining planarization of a conductive (copper) layer deposited on a substrate in the presence of a work-piece surface influencing device.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to transmit another beam of light onto the top surface of the work-piece to obtain another reflected beam of light; and detect another change in a characteristic of the other reflected beam of light indicative of another material forming a new top surface of the work-piece as taught by Lee. One of ordinary skill in the art would have been motivated at the time of invention to use the detection method of Lee to monitor the planarization method of the instant application as Lee teaches that the disclosed optical detection method is suitable for the intended purpose as stated. Note that the admitted prior art teaches that it is conventional to remove all of the conductive material from the field regions and thus another material is on the top surface. This feature is also illustrated in Figs. 3 and 7 of Lee et al. for example.

Regarding Claims 59, 63 and 64, Lee et al teaches that the intensity of light decreases as the thickness of the copper layer is reduced. In the process of the admitted prior art the thickness of the copper layer is increased and so the intensity of the light would be increased as the surface is planarized.

Regarding Claim 39, It would have been obvious to one of ordinary skill in the art at the time of invention to use the same source for the beam of light and the another beam of light in order to reduce the amount of equipment and expense needed for processing since the same source is capable of

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transmitting the beam of light and the another beam of light is transmitted after the beam of light is transmitted.

Regarding Claims 60 and 61, both the admitted prior art and the disclosure of Lee et al. teach that the conductor is copper.

Regarding Claim 62, the admitted prior art and Lee et al. teach that it is conventional to form a barrier layer before depositing the copper layer. The barrier layer forms the top surface of the workpiece as the copper is removed from the top surface. Therefore the step of detecting the change in a characteristic of the other beam of light would be indicative of the barrier layer on a top surface of the workpiece.

### ***Conclusion***

This is a request for continued examination of applicant's earlier Application. All claims are drawn to the same invention claimed in the earlier application and could have been finally rejected on the grounds and art of record if they had been entered in the earlier application.

Accordingly, **THIS ACTION IS MADE FINAL** even though it is a first action in this case. See MPEP § 706.07(b). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no, however, event will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Roberts Culbert whose telephone number is (571) 272-1433. The examiner can normally be reached on Monday-Friday (7:30-4:00).



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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory Mills can be reached on (571) 272-1439. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

R. Culbert



*P. Hassonzedt*  
*Primary Examiner*  
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